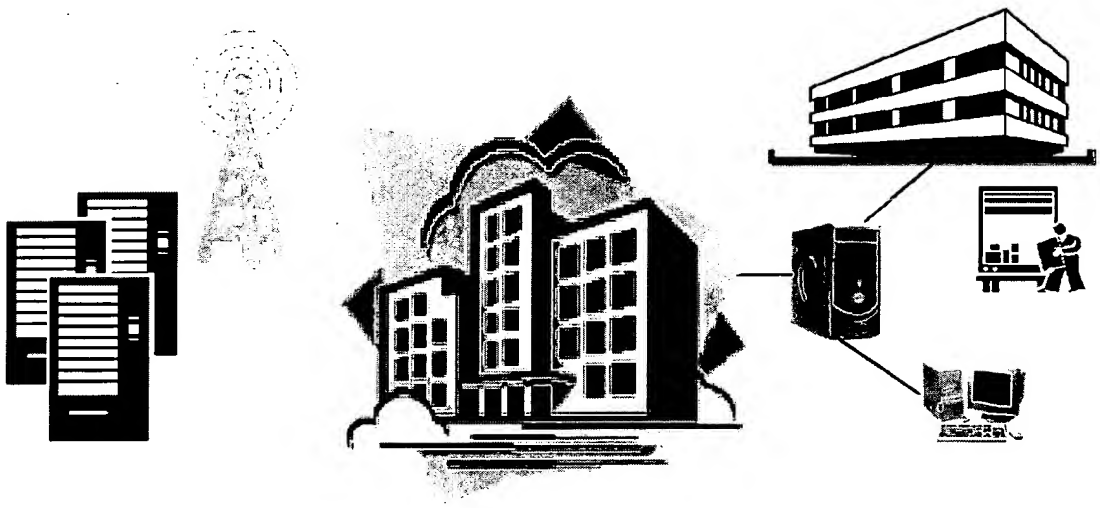
NAMA WHITE PAPER

REMOTE MACHINE MONITORING



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Remote Machine Monitoring (RMM)

Introduction

There is an old business adage that states, "What is not measured is not monitored; what is not monitored is not managed; what is not managed is not controlled." These same guidelines are applicable to the vending industry. Machines that are not closely monitored can negatively impact both the vending operator and product customers. Failure to track product movement, cash inventory, and physical conditions of a machine often results in poor financial performance, sloppy maintenance, and ineffective cash management. Undetected product shortages, mechanical or electrical fluctuations, outdated pricing, insufficient change, and the like can impact contractual relations and location profitability. Fortunately, technology suppliers have introduced remote machine monitoring (RMM) applications that enable telemetry communication using wireline and wireless networks as well as web-based interactive analysis. In other words, operators are able to retrieve DEX and other data from vending machines equipped with RMM technology. RMM is a logical enhancement to vending management software as it includes real-time data processing for current, accurate, and timely reporting. There is probably no vending technology application with greater potential for return on investment than RMM.

Increased profitability through reductions in out-of-service machinery and product stockouts, improved cash and cashless transaction processing, and rapid notification of machine events are important factors in effective vending management. Timely replenishment algorithms, efficient route planning, effective warehousing, timely account servicing, and related considerations can be used to streamline routes and optimize replenishment functionality. With RMM, vending operators are able to maintain high levels of service by correcting machine-based problems before they become dysfunctional or debilitating. A primary objective of RMM is to poll each machine daily to determine when product replenishment, cash collection, and/or maintenance is appropriate. Generally, RMM relies on network communications to:

- Relay transactional information
- Monitor product sales activity
- Recognize low product inventory
- Track cash movement and inventory
- Trigger alerts when mechanical problems or malfunctions arise
- Export machine-level data to vending management software (VMS)
- Report other problematic conditions

RMM is gaining traction throughout the vending industry as transmitted data can be used to identify accounts requiring replenishment or servicing, determine product inventory restocking, and information relative to cash balances in each machine. RMM has the potential to revolutionize vending management through real-time information leading to more efficient solutions. Having knowledge of problematic conditions before they become compounded is very important.

Objectives of RMM

The objectives of remote machine monitoring (RMM) include:

1. Identification of machines requiring cash collection, cash replenishment, and/or coin mechanism or bill validator service.
2. Automatic relay of problematic conditions (e.g. power fluctuation, vandalism, or peripheral malfunctions) as they occur. Early identification of machine malfunctions will enable more rapid corrective action.
3. Determine machine product replenishment requirements in advance of route visit, or pre-packing, as a result of par stock (desired quantity) or mini-max (predetermined order points) evaluation.
4. Monitor accounts requiring servicing in order to reduce route times in advance of route circulation through dynamic scheduling. RMM vendors estimate route driver time savings at 11-15% based on pre-route activity.
5. Reduce the number of round trips between route truck and vending machine for refilling, servicing, or cash collection. RMM vendors estimate time savings of 15-20% derived from reduced machine travel. Those actually using curbside polling, report time savings as great as 35-40%.
6. Optimization of route scheduling by restricting planning to only machines requiring attention; referred to as dynamic routing. RMM vendors estimate 1 in 5 machines (20%) typically visited per route do not require service.
7. Increased product volume as sales data is used to determine near sold out conditions thereby triggering immediate replenishment.
8. Cost containment through optimized machine servicing
9. Improved customer satisfaction derived from having the right product at the right place at the right time.
10. Lower overall inventory investment dollars as better information yields an approximate cost of goods sold (COGS) savings of about 30%.

Summary of RMM Advantages

- Rapid relay of DEX data
- Monitor vending prices
- Improve driver/route efficiency
- Enhance cash accountability
- Increase product sales
- Deter fraud and product theft
- Decrease record keeping/paperwork
- Rapid alert notification (email, cell, web)
- Receive rapid access to database
- Manage e-locking devices
- Enables dynamic scheduling
- Enables dynamic routing
- Enables pre-picking.
- Simplex and duplex optional communications

RMM Networking

RMM applications can be accomplished through a variety of network technologies, including wireline, wireless, telephone, and Internet. RMM equipped vending machines are configured to transmit data over a network to a connected server. Vending machines are polled daily and sales and alarm data is transmitted to a remote solution provider's network for analysis and data storage. The remote application software typically analyzes the data to determine the inventory status of products sales, by column, of each machine. An additional forecasting algorithm may be applied to predict additional sales likely to occur by the time of the next date of service. This data can then be used to provide a dynamic replenishment and service schedule.

Transmissions can be scheduled or on an emergency basis. Once received, machine level data is analyzed to reveal sales, cash collection, and service/alarm data. A forecasting algorithm can then be applied to predict sales from the time of data transmission through until the next expected route visit. This data can be used to determine a dynamic schedule. A given route may include machines regularly serviced and others scheduled dynamically based on product and/or coin/currency forecast. The decision to visit a specific machine can be made based on parameters set by management and applied within the software. Once a dynamic schedule is derived, its contents can be used to construct pre-pick lists for each machine and can then be aggregated to produce location, route, and truckload reports.

Curbside polling provides accurate, real time data without the need to apply a forecasting algorithm, thus eliminating the need for expensive monthly recurring network service charges. By adding an inexpensive cellular dialer the vending machine is capable of reporting alarm events back to the office. At the present time Compuvend has been awarded a Patent -Pending designation for it's curbside polling product.

Data Polling

There are three types of data queried during a RMM application: DEX product data, coin/currency data, and maintenance/alarm data. The fact that vending equipment tends to be strategically placed in disparate locations presents a challenge to efficient replenishment, sales analyses, malfunction notification, and comprehensive audit reporting. Fortunately, machine-level transactional data can be captured through an electronic control board supplied with most late model vending machine, 1996 or later. Inexpensive, after market kits are available to retrofit older machine for Dex compliance. Patents for these devices were issued to Audit System Corporation. Aggregating machine-level data enables remote review of transactions and inventory without having to have a physical presence at the machine. The fact data can be exported to a truck, remote warehouse, central office, or product fulfillment center extends the opportunity for more thorough, immediate, and frequent analysis. A majority of v-commerce applications are the result of DEX implementation.

In the past, machine manufacturers varied in how data exchanges and transmissions occurred. Recently released DEX software (Edition 6 and higher) tightens the specifications of the protocol to prevent possible misinterpretations in accountability or brand identification. Since there has been a proliferation of diverse vending products, and several variations in the packaging of the same product, the DEX standard has been refined to acknowledge and differentiate between product offerings. While not all vending operators demand identical informational output, vending machine circuit boards are built to possess similar data collection capabilities to ensure the delivery of consistent content. For example, three data elements referenced in the DEX standard are: 1) number of bills held in the bill stacker, 2) quantity and denomination of coins stored in the coin box, and 3) number of vends or products sold.

A DEX-compliant machine relies upon DEX architecture to enable vending machine polling. The vending machine exports its unique identification number and stored data to an external system for analysis and processing. An optional element of this data stream is the machine's service history, including the last date the machine was serviced. Once DEX data is exchanged with a vending management system various transaction audits can be performed. Since captured data is not accessible or editable prior to interfacing to an auxiliary system, cash accountability will be accurate and complete. Also, the ability to track product information at the machine-level enhances productivity, as machine fulfillment is improved and manual data entry eliminated. The DEX protocol enables different makes and models of vending machines to communicate in a consistent manner. DEX data sets include sales mix, cash collection, product movement, and malfunction alerts. Additionally, DEX specifications may soon include a standard for reporting error codes for payment validation, dispensing jams, and other operational problems. Proposed specifications are pending approval.

Since vending machines have an average life of fifteen years, it may take a generation of new machine installations to fully realize the DEX potential. Basically, DEX provides an indisputable, auditable accounting method for cash collections, units sold, and product price recordation that capable of enhancing route efficiency and improving warehouse operations. For example, how much cash should be in a machine at the close of a sales period? A route driver, unable to view the DEX electronic record, will have cash collections compared against the machine-level electronic record. Balancing cash against collections provides management with a unique level of information and control.

DEX Polling

NAMA and the European Vending Association (EVA) have jointly adopted a communication protocol for the electronic retrieval of machine-level information via data polling. As a consequence, vending machines are now manufactured as DEX-enabled. Each vending machine is given a unique identifying number by which the DEX data extracted is labeled. During a polling session, this unique number and the date and time that the service occurred, are transmitted to the polling device. DEX data is polled an audit can be performed. Since captured

data is not accessible or editable by the route driver, cash accountability is assumed accurate and complete. Also, the ability to track product information at the machine level enhances productivity as route time is improved and manual data entry is eliminated. DEX specifies a data format to enable all different types of machines and machine models to communicate electronically in a similar manner. The DEX information available includes: sales, cash collections, product movement and other vending machine activities.

There are three distinct and different levels of DEX data collection: machine, curbside, and remote. Machine data capture involves plugging a handheld device in a machine's DEX port. Many DEX ports enable the VMC to detect the insertion of the handheld device plug so that it serves as a signal to start the DEX data gathering process. Since remote telemetry will not involve an actual plug insertion, the DEX application may be designed as if a device were constantly plugged in. In this case, to initiate the DEX gathering process (via virtual connectivity) the external technology needs to be connected to a logical signal control device capable of communicating the initiation signal for the DEX gathering process. Curbside collection includes data collection away from the machine but in relatively close proximity, up to one mile through wireless connectivity. Remote data collection involves use of telemetry technology such as telecommunications, GSM (global system for mobile communications), AMPS (analog mobile phone system), GPRS (general packet radio service), Ethernet linkage, VPN (virtual private network), or Internet service. The most common network connectivity options to date include both Internet and VPN connectivity. The Internet is a public network that presents connectivity challenges based on the architectural structure surrounding the vending equipment combined with strength of signal requirements and the cost of an Internet Service Provider. Connectivity to a VPN is more direct and less susceptible to structural infringements but tends to be more costly. Vending operators are benefiting from such devices as hand-held terminals, personal digital assistants, smart paging units, global positioning systems, telecommunication links, proximity transponders, and related techniques. Additionally, the DEX specification contains a standard for reporting error codes for payment validation, jams, and other operational problems. Line item tracking is important to both accountability and assistance in future machine menu development. DEX data retrieval can be accomplished via three distinct polling modes: 1-machine polling, 2-curbside polling or 3- remote polling including wireless, dialup, wide area network or cellular polling.

A. Machine Polling – customarily incorporates a hand-held computer with on board software that calculates refill quantities, tracks inventory and enables the vending driver to generate reports directly from the hand-held computer, data is also down loaded to a host computer for processing and archival purposes and more detailed report generation. Other machine polling systems incorporate a hand-held device designed to plug connect to a vending machine's DEX-port or to communicate through an IR port. Once the connection is established, the device is used to extract (upload) transactional data from the machine to the

handheld device. Field collected data can be transferred from the handheld device to a central office computer (uploaded) for processing, analysis, and report generation. A typically DEX data upload takes approximately five to fifteen seconds.

B. Curbside Polling – Uses a unique wireless technology and makes it possible to collect DEX data from the comfort of a route truck parked within proximity of the location, currently up to a mile. Unique receivers attached to hand-held computers are utilized to capture the transmitted Dex data that is interpreted by the computer and displays replenishment information (pick ticket). Curbside polling eliminates the need for two trips when filling machines. Curbside polling is considered the best method for handling daily, unpredictable inventory machines. Curbside polling does not incur line charges or monthly fees within the network and is the least expensive polling option.

A curbside polling system enables a route driver to collect real-time machine-level data prior to entering a vending machine location. This data will indicate the percentage empty information that can be used to determine whether machines require replenishment or not, in less than 15 seconds. This approach provides an opportunity either to eliminate unnecessary trips between the route truck and vending machine as the driver will be able to pack the exact quantity of replenishment items before leaving the truck.

Curbside polling requires a sender (transmitter) and receiver to create a network for data exchange. The transmitter is placed inside the vending machine and attaches to its DEX output port. This device will be responsible for collecting and sending DEX data (e.g. column sales, cash collected and cashless transactions) to a remote receiving device. By using a receiver instead of a transceiver the cost of the device is 50% lower. The route driver, to remotely access the aggregated DEX data from the transmitter, uses a HHC (handheld computer) or PDA attached to a receiver. Without leaving the vehicle, the route driver becomes aware of item and cash inventory levels and thereby determines how much product and coinage are needed to replenish the machine before leaving the truck. The DEX data may also reflect the fact that no service is required. The HHC stores the DEX data collected throughout the route. This information is later used for daily cash and product accountability. While curbside polling is a time saving technique, it has also been credited with increasing sales (6-7%), improving driver satisfaction and retention, and enhancing route driver commissions.

C. Remote Polling

1. Dial-up Polling – dial-up polling involves use of a modem and telephone line. Once a valid connection is established, DEX data can be transported to a remote office or warehouse location for evaluation over an Internet or virtual private network (VPN) connection. Dial-up polling may require a dedicated phone line connection for each vending machine or simply one line connected to a master

DEX data consolidation device. Phone line availability, line charges, service fees, location permission, and the like may present barriers to successful connectivity. Dial-up polling enables a machine to be remotely monitored with respect to cash, inventory, and machine alerts and malfunctions

2.Wireless Polling – similar to other forms of polling, wireless polling enables remote access to DEX data via a network. Wireless polling however relies upon network connectivity to establish the proper linkage. The advancement of wireless technology has emerged as an attractive alternative. Wireless applications possess tremendous potential for the vending industry, an industry that desires mobility, flexibility, and reliability in enterprise-wide operations. Vending practitioners dissatisfied with the constraints and complexities of hard wiring are migrating to the convenience of design portability and user mobility that wireless technology solutions provide. Note: regardless of polling methodology, collected data should be processed effectively by vending machine software (VMS). It is the VMS that takes responsibility for the proper storage, management, and application of analytical algorithms, database functionality, and report generating modules to the collected data.

Common network connectivity options include both the Internet and virtual private networks (VPN). The Internet is a public network that presents connectivity challenges based on the architectural structure surrounding the vending equipment combined with strength of signal requirements. Connectivity to a VPN is more direct and less susceptible to structural infringements but tends to be more costly. Vending operators are benefiting from such devices as hand-held terminals, personal digital assistants, smart paging units, global positioning systems, telecommunication links (telemetry), proximity transponders, and related techniques.

3.Cellular Polling – usually a single machine with a cellular modem, located in a cluster of machines, can serve as a master unit for data transference and machine monitoring. The master (or host) unit gathers DEX data linked (slave) units within an approximate 1000-yard radius. Readings can be performed hourly, or at user-defined intervals. Cellular modem applications tend to be more cost effective in locations where remote polling is problematic or placing a land-line is impractical. A cellular modem typically involves recurring monthly service fees and related expenses

RMM Related Technologies

A guideline for RMM communication costs is to adhere to a $6-7 per month per machine expenditure (amonline.com) with the exception of curbside polling which has no monthly recurring charges. The following technologies have been used by RMM vendors:

AMPS *– Advanced Mobile Phone Service -- the standard for analog cellular technology in the United States.*

CDMA *– Code Division Multiple Access -- cellular phone service network used throughout much of the US; rare elsewhere in the world. CDMA uses spread spectrum technology and does not assign a specific frequency to each user. Instead, every channel uses the full available spectrum. A consistent voice and data mobile communication platform that supports 3G technologies.*

CDMA2000 *– third generation, or 3G, version of CDMA*

CDPD *– Cellular Digital Packet Data -- wireless Internet access using packet switching thereby eliminating the need for a persistent link; has been replaced by higher-speed CDMA2000 3G networking.*

Ethernet *– a widely implemented local area network (LAN) architecture that supports data transfer rates of 10 Mbps. High speed versions of Ethernet include 100Base-T (100 Mbps) and Gigabit Ethernet (1,000 megabits)*

GPRS *– General Packet Radio Service – cellular data technology for GSM networks providing 10 – 50 kbps of bandwidth.*

GSM *– Global System for Mobile Communications – primary digital cellular phone service network used throughout much of the world outside the US; is becoming more popular in the US but is a comparatively slow at 9600 bps. GSM uses narrowband TDMA which allows eight simultaneous calls on the same radio frequency.*

MMS *– Multimedia Messaging Service – enables users to exchange messages containing text, pictures, sounds, and other media over cellular phones.*

RFID *-- Radio Frequency Identification -- technology used to uniquely identify objects. A transceiver broadcasts a signal that activates a remote transponder that sends data back to the transceiver.*

SMS *– Short Message Service – method for sending text messages no longer than 200 characters to GSM cellular phones. Messages delivered at a low cost and almost instantaneously.*

SPR *– Spread Spectrum Radio – radio technology created by the U.S. Military for its frequency hopping capabilities ensuring reliable communication and excellent encryption. Operates in the 928.xx frequency range free of licensing fees.*

***TDMA** – Time Division Multiple Access – a technology for delivering digital wireless service by dividing a radio frequency into time slots and then allocating slots to multiple calls. TDMA is used by the GSM digital cellular system.*

***VPN** – Virtual Private Network – a secure network constructed through public nodes (typically the Internet) that enable secure data encryption and transportation for authorized users.*

***WAP** – Wireless Application Protocol – a set of standards enabling wireless devices to access the Internet.*

Forms of RMM

With the exception of curbside polling, all DEX data passes through a network and most a web-server before reaching a vending management software system (see Figure One. Comparative Capabilities of RMM Strategies).

1. Curbside: DEX data is transmitted so the driver in the truck can receive this data in a HHC, which will generate a picking ticket to be displayed and/or printed. This method can be especially effective if an operator does not wish to employ dynamic scheduling, dynamic routing or pre-packing machine fill orders at the warehouse. This alternative is effective for downtown limited parking, and controlled access locations like prisons and security intensive locations.[CompuVend is the only provider of curbside polling]

2. Wireline: A master unit, wired to each machine in a bank of machines, is used to poll and collect machine-level DEX readings. The master unit normally gathers readings in low volume times (i.e. middle of the night) and uses an outgoing facsimile (fax) line to transmit the DEX data to an off-premises location. This is a low cost approach as outbound fax calls are typically conducted through a local or toll-free number. Wireline, also referred to as land line, requires the vending operator secure telephone access. [sample suppliers: Protel and ASC]

3. Cellular: subject to local area coverage by a cellular carrier; easily deployed. "Slave" machines within 1000 feet of a cellular modem "master" machine transmit DEX data (to the master) using RF/LAN frequencies. The frequency of transmission is typically once per day. [example suppliers: Cantaloupe and Protel]

4. RF LAN/WAN: each machine is configured with a transceiver for passing its DEX data to the next closest machine; the last machine in the chain contains a master IP link that, in turn, connects to a cellular, dial-up or Internet connection. In this scheme polling fees are minimized but machines need to be networked into concentric circles around IP links for data collection. [example suppliers: ASC]

5. Cashless, through the daily process of RMM transmission, cashless payment transaction files can normally be simultaneously sent (i.e. hitch hiking). The same is true for several electronic locking products. USA Technologies is a major participant in multiple applications transmissions.

Data Transport Methods

1.MACHINE METERS –sales and cash meter readings (manual process)

2.HANDHELD PCs – downloading of machine DEX data (digital capture)

3.CURBSIDE POLLING – remote retrieval of DEX data (simplex: 1-way to accommodate packing-out products from the truck)

4.REMOTE MONITORING – telemetry transport of data (simplex: 1-way) (This is two way communication, it also has a transceiver it has to trigger the machine sending the Dex data)

5.ONLINE ACTIVITY – web-based polling and reporting (duplex: 2-way)

RMM Synergy

Three advancements continue to influence the potential attractiveness of remote machine monitoring:

- The costs associated with hardware components as well as transmission networking have been reduced thereby lowering the expenses associated with remote monitoring. As telemetry techniques stabilize, communication standards are becoming more readily available. The use of dedicated, dialup, and wireless channels, permitting shared connectivity among multiple machines, also provides cost savings.
- Direct integration with vending management software provides a platform for lower installation and operating costs as transported data is readily available for processing. Regardless of whether the telemetry is the result of an extended vending management software module or a contracted partnership with a remote machine monitoring firm, synergy likely will be experienced through implementation.
- An established communication link enables the transmission of both transactional and event information as well as the transportation of cashless purchase records. The same channel that transports RMM data is also capable of carrying cashless settlement data thereby incurring little, or no, additional expense. The same is applies for some electronic locks.

Common RMM Metrics

All remote system applications tend to share some common attributes:

- Polling machine-level DEX data – interrogating the machine typically happens once per day since the polling process may necessitate the vending machine being off-line for 10-40 seconds. If communication costs are insignificant, data may be transported more frequently.
- System monitoring of transactional and event data – early notification of problematic condition can be relayed in real time so emergency machine service calls can be scheduled for rapid corrective action.
- At the end of the day, the best system may involve a combination of different methods. An early hope of early remote DEX collection systems was that driver handhelds would not be needed. Since most drivers use handhelds for inventory, product plan-o-gram changes, and collecting additional data (like refunds and test vends) during the day, most operators would still choose to use handhelds even if most machines have remote connections.

Data Collection Models
Several factors contribute to the viability of remote data collection and monitoring:

1- **Cost Containment** -- hardware and communication expenses (e.g. wireline, cellular, and Ethernet costs) have declined and become more reasonable as technology standardization is more widespread;
2- **Interconnecting Machines** – configuring a group of vending machines to form a bank, or block, capable of sharing a single point of connectivity to minimize expenditures; sometimes referred to as a machine-to-machine [M2M] configuration;
3- **Integrated Application Software** -- industry software suppliers have developed integrated remote monitoring software or have partnered with remote monitoring companies to form an integrated package;
4- **Cashless Vending** -- since cashless vending settlement involves a communication link to authorize payment processing, the same technology can be used to transport DEX data to a vending management software system, at little or no additional cost.

Remote DEX-data transmission typically is conducted at predetermined intervals (e.g. historically night-time was preferred as the polling process may render the vending machine inoperable for 10-40 seconds) and is dependent on sensitive connectivity prone to communication conflicts, outages, or damage as a result of electrical interference, weather, or vandalism. Since route drivers tend to use handheld terminals to track inventory, product plan-o-gram changes, and additional data (like refunds and test vends) during the day, a majority of operators have opted to transition to remote connectivity options in the evening as a compliment to handheld data capture. A principle reason vending management software utilizes DEX data is its ability to audit cash management and product shrinkage.

METHODOLOGY	ADVANTAGE	DISADVANTAGE
Machine Level -- handheld device plugged into machine DEX port	Inexpensive (expense limited to cost of handheld device). [Necessary for final verification.]	Data collected only when machine is attended or serviced.
Curbside Polling	Inexpensive, private network simple to install, maintain and operate. No recurring charges	No online data collection to the office at this time.
Remote Wired Telephone Modem – dialup remote telecommunication data collection	Data transmitted remotely (may be local or long-distance call with recurring fees). Depending on technology, numerous (>20) machines can share same modem/phone line. No dedicated line required.	Telephone switch required in close proximity to machine or bank of machines sharing a single telephone line (analog, digital, or cellular)
Remote Ethernet Network -- remote data collection	With Ethernet connectivity data tends to be relatively inexpensive. [May involve unique permission issues.]	Not well proven -- may encounter difficulty transmitting through corporate firewall
Remote Wireless Cellular -- system remote data collection	Data transmitted remotely by cellular modem. Typically, no special wiring required	Expensive (setup costs and recurring fees) and reception not always available or strong. [Problems may evolve from wireless carriers not equipped to handle fixed-base devices.]

Table One. DEX Data Collection Models
[Glenn Butler, Streamware, Inc.]

Figure 1 – Comparative Capabilities of RMM systems

Features	Meter	Handheld	Curbside	RMM	RMI
Basic data collection	•	•	•	•	•
Basic cash accountability		•	•	•	•
Percent empty report		•	•		
Pre-picking		•	•	•	•
One walk visit to location			•	•	•
Advanced cash accountability			•	•	•
Better resolution of data			•	•	•
Item sell out report			•	•	•
Hardware expandability			•	•	•
No need to visit all machines			•	•	•
Pre-packing at warehouse				•	•
Requires complex forecast algorithms				•	•
Dynamic scheduling				•	•
Instant error reporting				•	•
Remote device upgrades				•	•
Remote price changes				•	•
Recurring monthly charges				•	•

RMM Event Reporting

Events are occurrences in a vending machine device that get stored and reported to the data carrier when an audit is performed. Although events can often be faults in a machine, they also indicate normal functions such as door openings or closings. For each event the date, time, and duration of the event and cumulative number of events is tracked. In general there are two types of events: equipment events and operational events. In order to minimize the amount of data needing to be transferred, only the event reference codes are

transferred, leaving implementers of machines and databases free to describe specific events, as they deem appropriate.

Transactional data
Purchase activation (coin, bill, cashless)
Product selection
Product dispensing
Change tendering
Currency Report [Coins to tubes and bills to box]
Cashless/Electronic transaction details

Event data

- Door openings
- Cash collections
- Jams in coin tube (non re-settable)
- Failures to dispense (non re-settable)
- Repeat attempts to dispense
- Temperature variances
- Tilt / Security conditions (non re-settable)
- Other emergency alerts (non re-settable)

Sample Set of Equipment Events
Bill Validator Jam (non re-settable)

- Cabinet Door Open
- Cashless System Malfunction (non re-settable)
- Coin Mechanism Failure (non re-settable)
- Communication System Error (non re-settable)
- Control System Problem
- Dispensing System Calibration
- Refrigeration Fluctuation

NOTE: that as indicated these events are none re-settable occurrences and a majority of the time they are self correcting, resulting in a false alarms.

Sample Set of Operational Events

- Cash Collection
- Credit Card Initiation
- Machine History Log
- Product/Operational Request
- Service Related Request

RMM Applications

Vending management applications are significantly enhanced through the incorporation of accurate and timely remote machine generated data, including:

- Dynamic Forecasting – having data indicating when coins or currency stored in a vending machine require collection or knowing machine inventory levels for pre-pick replenishment or awareness of maintenance or service alarms in advance of route trafficking can be of assistance in determining warehousing needs as well as tracking product movement. Pre-packing products at the warehouse can prove to be a significant impact on route truck driver efficiency.

- Dynamic Notification – machine communication of events and alarm conditions can be used to monitor and manage machines. Key factors related to machine functionality, inventory movement, and stored money based on such evaluation, the software can build a route schedule for each machine and provide the operator with a sound basis for pre-kiting.

- Dynamic Pricing – two-way communication between a machine and remote computer can enable remote price updating. Duplex transmission of provides a platform enabling price updating from a distant location.

- Dynamic Scheduling – since not all machines will require service, collection, or replenishment on a regular basis, a dynamic scheduling algorithm is capable of constructing a flexible route schedule without reliance on inefficient, fixed routing. While some machines may require attention on a regular, static basis, most will not. Hence, dynamic scheduling based on timely remote data polling can be used to develop appropriate service, cash collection, and/or replenishment scheduling. The main advantage of remote monitoring is to enable daily machine polling to determine operational and inventory status. With this type of data, vending operators can contemplate Dynamic Scheduling. Using this paradigm, instead of sending drivers on a predetermined route on each day of the week, the DEX data and software decide which machines need servicing each day. This data can then be shared with routing systems to determine the most efficient path for the vending driver to take each morning (dynamic routing). DS can be employed to determine tomorrow's machine service schedules based on product depletion targets, which can eliminate needless over-services. DS overrides the static service schedule if a machine does not qualify for service, based on its depletion target. Depletion targets average around 50% for beverages and 30% for snack machines.

- Dynamic Routing – given the flexibility of scheduling, routes can be built based on route stops requiring service or replenishment. Dynamic

routing software can be applied to produce an efficient routing scheme.

Operational Considerations

The benefits of remote machine monitoring enable real time analyses in three critical operational areas: product sales, percent empty (see Figure 4, compliments of CompuVend, Inc.), and change status. Product sales involve the development of replenishment scheduling guidelines based on product mapping and product movement. Percent empty refers to an evaluation of remaining contents and the desirability to bypass machines not requiring replenishment. Popular replenishment metrics suggest visitation to a vending machine only when 50% of snack products remain or 30% of cold drinks are left for purchase. RMM advocates report service time savings as high as 50% with dynamic routing and scheduling algorithms.

RMM data analyses may include:

- ✓ Brand Preference Analysis (menu mix)
- ✓ Space to Sales Analysis (column allocation)
- ✓ Machine Operations Report (malfunctions)
- ✓ Two-Way Communications (interactivity)
- ✓ Route Productivity (efficiencies/effectiveness)

RMI Web-Based Applications

Remote machine interactivity (RMI) is the result of two-way, duplex communication between a vending machine and a remote web-based application. RMI is the result of data gathered from dispersed machines to a centralized vending management software system. The data is then evaluated against a complex set of algorithms where it is converted from raw data into useful information presented in user-friendly report formats. End-users can then log into a secure website to access data by individual machine, by multiple machines, by location, by account, by client, or by other criteria. Web interfacing is designed for secure access and requires a unique, password protected user login. Based on assigned user access rights, data and information is available for standard or custom reporting.

Summary

A RMM system is made effective by the continuous monitoring and automatic warning capabilities that allow vending machines to be left unattended. A system that combines stand alone data and status collection, with a communication device capable of sending alerts (via pager, email, cell phone, or text messaging) is capable of monitoring the status of a variety of machine, product, and monetary conditions. The relay of product sales data, for example, can minimize wasted machine visits while enabling more efficient warehouse, route, and personnel scheduling. Often there are minimal modifications required to field-placed vending machines to initiate remote machine monitoring. Vending operators are now able to access real-time, critical machine-level data and integrate it with sophisticated web-based information systems.

Author Notes:

Curbside Suppliers

- CompuVend [Buzz Box] 800-341-7677

Remote Machine Monitoring Suppliers

- Cantaloupe systems [Seed] cantaloupesys.com 925-362-4824
- InOne Technology [EasyNet System] 800-558-8727
- eSecure Peripherals [eStore] esecureperipherals.com
- USA Technologies [ePort] usatech.com 800-633-0340
- Remote Vend Data 914-287-0095
- Protel 540-967-2872

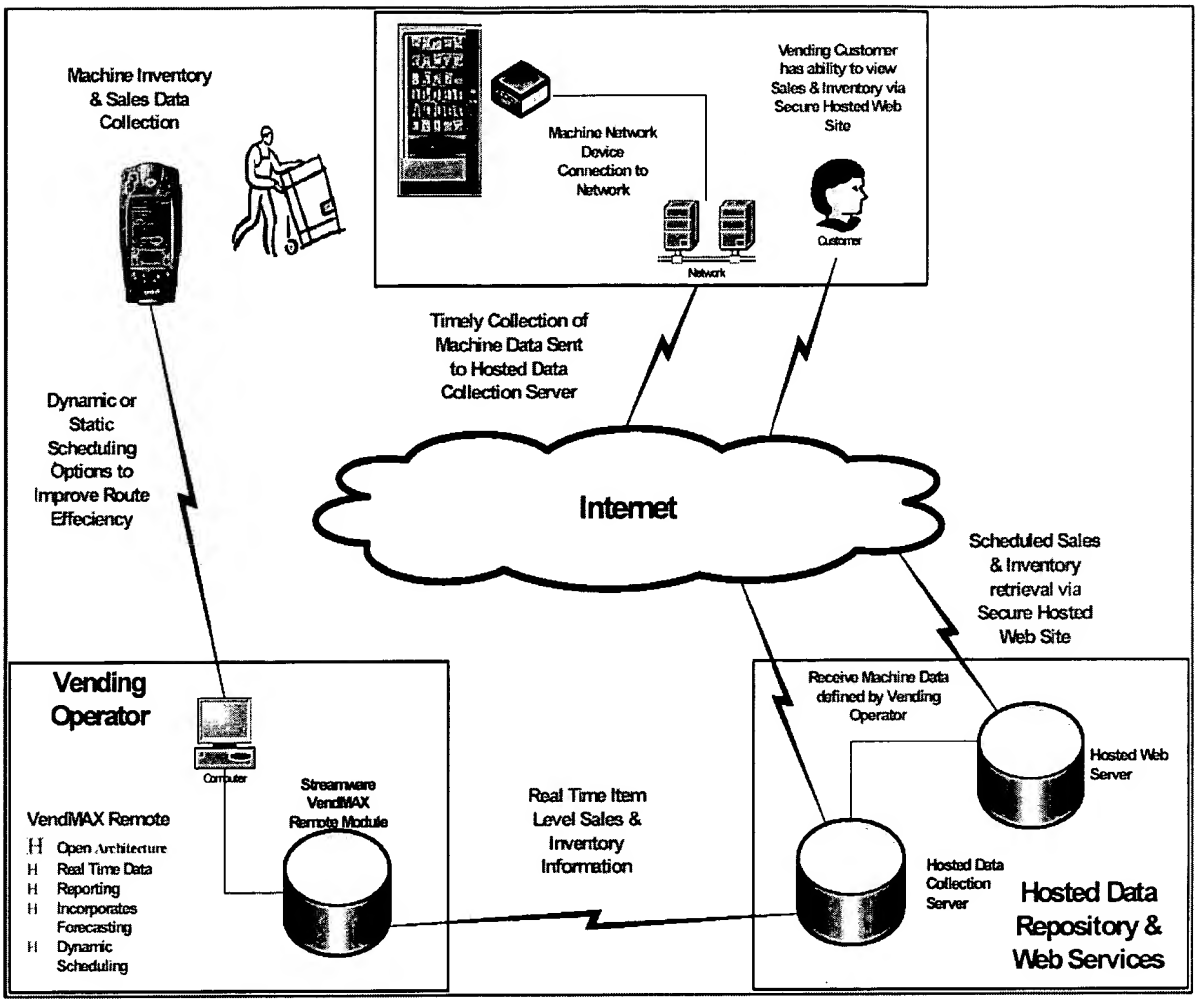

Figure Two. RMM Schematic Overview
Courtesy: Crane Streamware (2005)

GLOSSARY of TERMS

Baud Rate – measurement of speed; number of bits transferred per second

Curbside Polling – direct communication between a vending machine in a building and a route driver in his truck over a private network. Curbside polling does not rely on the use of complex algorithms to determine replenishment quantities, it provides Real Time Data.

Data Carrier – a device used to collect and transport machine-level data

Data Source – device that accumulates audit information and sends (or receives) it to (from) a data carrier

DEX – acronym for Data EXchange

DTS – acronym for Data Transfer Standard

Duplex – simultaneous 2-way communication flow in an electronic network

Dynamic Routing – scientific assignment of route accounts based on geographic relationship to a base route path given dynamic scheduling outcomes. For example, machines that overlap routes will be serviced by the driver closest to the machine at the time of service, on the targeted service day.

Dynamic Scheduling – eliminating machines from a fixed service schedule based on depletion targets developed through remote monitoring. Depletion targets average around 50% for cold beverage machines and 30% for snack machines. Knowing that some machines will not require attention enables dynamic routing.

Half-Duplex – 2-way data communication flow, but only one direction at a time, in an electronic network

Machine-to-Machine -- M2M – describes the exchange of transmissions between a vending machine and a remote network server (second machine)

Percent Empty – indicates the amount of product that has sold in relationship to machine capacity.

Pre-Packing – the act of pre-picking replenishment products based on remote machine inventory statistics or forecasted quantities. Pre-kitting in the warehouse can reduce route driver machine service times while optimize route truck capacity.

Simplex – one-way data communication flow in an electronic network

Space to Sales – metric that assures the right product mix is in place by allocating spirals based on product movement. The ratio of contribution margin to occupied space to identify products needing replacement or retention (V-engineering)

SPR *– Spread Spectrum Radio – radio technology created by the U.S. Military for its frequency hopping capabilities ensuring reliable communication and excellent encryption. Operates in the 928.xx frequency range free of licensing fees.*

Telemetry -- automatic transmission of data from a remote source to a designated receiving station thereby establishing machine-to-machine (M2M) communications; a measurement of characteristics (called measurands) for transmission to a distant station for recordation and analysis. Users can receive alerts via email or text messaging necessitating service to avoid downtime or inventory shortfalls.

Glossary: Cellular Technology

AMPS *– Advanced Mobile Phone Service -- the standard for analog cellular technology in the United States.*

CDMA *– Code Division Multiple Access -- cellular phone service network used throughout much of the US; rare elsewhere in the world. CDMA uses spread spectrum technology and does not assign a specific frequency to each user. Instead, every channel uses the full available spectrum. Supports 3G technologies.*

CDMA2000 *– third generation, or 3G, version of CDMA*

CDPD *– Cellular Digital Packet Data -- wireless Internet access using packet switching thereby eliminating the need for a persistent link; has been replaced by higher-speed CDMA2000 3G networking.*

GPRS *– General Packet Radio Service – cellular data technology for GSM networks providing between 10 – 50 kbps of bandwidth.*

GSM *– Global System for Mobile Communications – primary digital cellular phone service network used throughout much of the world outside the US; is becoming more popular in the US but is a comparatively slow at 9600 bps. GSM uses narrowband TDMA which allows eight simultaneous calls on the same radio frequency.*

MMS *– Multimedia Messaging Service – enables users to exchange messages containing text, pictures, sounds, and other media over cellular phones.*

RFID *-- Radio Frequency Identification -- technology used to uniquely identify objects. A transceiver broadcasts a signal that activates a remote transponder that sends data back to the transceiver.*

SMS *– Short Message Service – method for sending text messages no longer than 200 characters to GSM cellular phones. Messages delivered at a low cost and almost instantaneously.*

TDMA *– Time Division Multiple Access – a technology for delivering digitral wirelss service by dividing a radio frequency into time slots and then allocating slots to multiple calls. TDMA is used by the GSM digital cellular system.*

WAP *– Wireless Application Protocol – a set of standarda enabling wireless devices to access the Internet.*

RMM Benefits

- Remotely monitor temperatures within vending machines to maintain product quality, keeping historical logs if required.
- Detect coin jams and other outages, alerting maintenance personnel via pager to minimize machine downtime.
- Monitor product levels to adjust inventory and plan restocking schedules.
- Send alarms if power failures, power fluctuations, or other malfunctions occur.
- Improve route driver productivity through advance information, inventory optimization, and dynamic routing.
- Maximization of sales per machine by enhanced product replenishment and space to sales analysis.
- Synergy created by transporting cashless transaction data along network configured for remote machine monitoring.
- Depletion targets can be established to optimize machine inventory and velocity.

RMM Supplier Profiles

Cantaloupe Systems

The Cantaloupe "seed system" is made up of a wireless network of vending machines and data collection points with web access to the collected data. A wireless serial device is placed into multiple vending machines where it harvests data from multiple monitoring points inside the vending machine. It then sends its information wirelessly to a cellular hub. Receiving this data from multiple machines, the hub is responsible for relaying the information to Cantaloupe Systems' network servers. Cantaloupe uses an array of serial wireless and cellular technologies to provide maximum coverage. Once the data has been transmitted, the information is then encrypted and stored in robust enterprise level databases and servers.

Using the seed web application, vending operators are able to securely access current or historical information, including sales, rebate, and inventory tracking. With this information, vending operators are better prepared to develop business strategies, replenish machine inventories, ensure accurate cash collections, pre-pick products for future routes, and know of machine alerts and malfunctions.

Cantaloupe Systems [cantaloupesys.com] telephone: 925-362-4824

CompuVend, Inc.

CompuVend USA, founded in 1980, is the premier provider of management and control software to the vending, office coffee, distribution, and food service industries.

Our offerings include vending solutions, technology and consulting. CompuVend was the first to market coin counter communications in 1983. The first vending route handheld in the entire world was introduced by CompuVend in 1987. CompuVend designed, developed and introduced the first affordable and reliable Remote Monitoring Technology with its release of Buzz Box Curbside Polling in 2001.

The Clarity Consulting Group of CompuVend, Inc. was formed in response to the multitude of requests for assistance with problems in such areas as: operations; business planning; theft and spoilage; machine merchandising; planograms; and more. The Clarity Group services start with a free evaluation. Offerings include monthly analysis and progress reports, on-site surveys and solutions, as well as management and employee motivation.

CompuVend's solutions, technology and consulting are based on the expertise gained with over 70 years of continuous vending operations. Prior to release to our client-base, our solutions are field-tested and fine-tuned in our own operations. CompuVend's simple, easy-to-use software and technology

solutions can be configured to handle the needs of any company, from small vending operators and distribution companies to multi-site regional and national corporations. Our Buzz Box Curbside Polling is can be implemented by any vending operation, regardless of their current software provider. Buzz Box does not rely on the CompuVend software platform to be used, but is instead an independent Remote Monitoring Method.

CompuVend [compuvend.com] telephone: 800-341-7677

eSecure Peripherals

eSecure Peripherals has been providing cashless payment solutions since 1998. Starting with a simple cash to credit system, the product line has evolved to a comprehensive product line that ranges from stand alone vending locations all the way up to internet based reporting and cash management. Located just outside of Montreal, the eSecure offices provide customer support, operator training, and engineering development in one central location. This allows eSecure to attend to the needs of the customer and transfer these to the engineering group for rapid development. Our R&D facilities are used on a daily basis for training and test, ensuring that the products delivered to the customer have passed all tests.

eSecure hardware and software is in service 24 hours a day throughout the United States and Canada. Each day, 10's of thousands of transactions are performed seamlessly in the hundreds of readers installed in locations from thruways to office campuses.

eSecure Peripherals [esecureperipherals.com] telephone: 450-443-9894

InOne Technology

Within the vending industry, It defines the transfer of information\data between a Hand Held Computer (HHC) or Data Collector and the electronic vending machine. The Food Marketing Institute, along with the major food retailers, defined the original DEX framework in the mid 70s. Their objective was to standardize the transfer of product information between a supermarket's computer and the delivery driver's HHC. Coca-Cola, recognized the benefit of faster back door check ins using the DEX concept and quickly merged it into their HHC software. As Coca-Cola moved more into electronic vending, they also realized that if their vending machines had DEX capabilities their CASH reconciliation could be both simplified and much more efficient. In the early 80's Coca-Cola began specifying basic cash DEX data capabilities in new vending equipment.

About 1986, NAMA's Vending Technology Standards Committee created the DEX Data Transfer Standard (DTS). This set the baseline for information to be collected in a vending machine and how that information would be retrieved. At that time, the DEX protocol was incorporated as an integral part of the DTS. Thus, a DEX standard was established, but continues to evolve, with both

vending machine and product manufacturers employing variations that fit their individual objectives, just as the mass-food retailers still do for their purposes. In the early 90's, recognizing the need for plug-n-play DEX upgrade technology and uniform DEX data access. Today the top 4 vending software providers rely on our DEX decoding library and field technician training to facilitate their DEX processing technologies. In 2000, we wrote the guidelines for the newly adopted Edition 6 of the international DEX DTS standard, at the invitation of NAMA and the European Vending Association (EVA).

In an industry where efficiency and controls make the difference in profits, inefficient processes can slowly cripple your business. Unnecessary stops, mistakes in accounting and reconciliation, and lack of efficiency and accuracy undermine profits in labor, materials and idle product. inOne's proven software and hardware solutions help your personnel pick up the pace of services while eliminating mistakes, providing you with gains in efficiency at every level. Call Gene Ostendorf at 410-666-3800.

InOne Technology [inonetechnology.com] telephone: 800-426-1487

Metretek

Since the late 1970's Metretek, Inc. has been a provider of machine to machine (M2M) connectivity and solutions. We have over the years worked with a large number of applications for the collection, processing, and management of remote field data. The company is most noted since the mid-1980's as being a significant provider of "Automated Meter Reading" (AMR) solutions to large investor owned gas and electric utilities to assist them in supporting the needs of their commercial and industrial (C&I) customers, as well as, a provider of Electronic Flow Computers. In this role Metretek has provided systems and application specific equipment to companies around the world including; North and South America, Europe, Asia, and Australia. Metretek, Inc. provides a full range of product and service offerings from which a customer can tailor a "needs based" data collection and management solution that best fits their requirements. We provide a number of different types of field based devices that can enable functions ranging from data recording, cathodic protection, gas volume correction, pressure and temperature recording, as well as, supporting specific device monitoring and reporting solutions. Metretek's DC2000 data collection and management software is based on Microsoft's SQL Server and is among the most cost effective, scalable, flexible, and robust applications of its type in the marketplace today. We also offer PowerSpring, an Application Services Provider (ASP) based data collection and reporting service for customers who prefer the flexibility provided by accessing their data directly via the internet. Over the past 25+ years Metretek has not only developed a significant number of products and services, but also considerable experience and expertise in its primary core competencies of hardware and software engineering, as well as, maintaining a solid reputation for providing a high level field support and world class customer service. Metretek, Inc. has been in the past and is once again today at the forefront of technological innovation and most recently has developed

communications solutions that will enable our customers to fully utilize the "wireless internet" that is today being provided by commercial carriers world-wide through "Third Generation" cellular technologies (3G). We offer everything from complete turn key solutions that include new application specific field devices, connectivity and data collection software, to "plug and play" products focused on replacing existing wire-line or obsolete analogy/CDPD wireless cellular services, while allowing the customer to retain their existing installed field equipment and "back office" data collection applications. Metretek is one of the few companies in the world that can reliably deliver solutions that range from large scale turn key "customer owned" solutions, internet ASP service based options (both of which are extremely scalable and can accommodate from a few dozen up to tens of thousands field reporting units), to customer/market specific solutions that integrate with existing legacy infrastructure. No matter what your situation we have products, tools, and experience that can help optimize your existing remote data collection and communications needs for maximum performance! Our mission at Metretek is to be a global provider of data collection and communications solutions that leverage the latest technologies available and are fully optimized to maximize the operating capabilities of each and enhance the overall business processes of our customers.

Metretek [metretekfl.com] telephone: 321-259-9700

PROTEL, Inc.

The Protel Pro-Star® monitor, which is installed in the vending machine, collects and automatically reports DEX data and normal operating conditions to the IVS® management software using the standard telephone network. Additionally, alarm conditions such as temperature out-of-range, door open and power failures are reported real-time for immediate notification. Using integrated circuitry, the Pro-Star® monitor transparently shares an existing telephone or fax line, eliminating the need to install a dedicated line or costly cellular service. The IVS® software then presents the data received from the Pro-Star® monitor in a user-friendly and customizable format, providing product consumption information, cash activity and alarms. The IVS® software also provides for machine inventory, warehouse stock levels, truck scheduling and customer commission calculation.

By using the Protel product each route driver is saving an average of two hours per day while servicing the same number of machines. In the morning the route supervisor prints the machine requirement pick tickets, generated by the IVS® software, and gives them to the driver. Previously, our route driver would go into the account, open each machine, enter product requirements into a handheld computer, return to the truck to pull product, then go back to fill each machine as needed. The Protel product eliminates this two-trip process. Equally as important as the time efficiencies I have gained, I have found by using the IVS® software and DEX data cash accountability comes within forecast. By using the dynamic route scheduling feature of the IVS® software, Mr. Breland also found that route efficiencies have increased by only visiting sites that require service. The Route

Scheduling module of Protel's system allows the operator to establish the criteria required for a machine to be scheduled for service. If the machine meets the required parameters, it is added to the route driver schedule for that day. If it does not meet the criteria, the machine does not require a site visit resulting in a more efficient use of time.

PROTEL, Inc. [protelinc.com] telephone: 800-925-8882